APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/004,891	12/07/2001	Paolo Faraboschi	10011518-1	7612

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EXAMINER
RUTTEN, JAMES D

ART UNIT	PAPER NUMBER
2122	

DATE MAILED: 11/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	10/004,891	FARABOSCHI, PAOLO
	Examiner	Art Unit
	J. Derek Rutten	2122

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>07 December 2001</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>24 April 2001</u> is/are: a)☐ accepted or b)☒ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

1.   Claims 1-21 have been examined.

Drawings

2.   The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the machine language code of claim 6, the compiler of claim 7, the assembler of claim 8, and the generation of one storage location per compilation unit of claim 9 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

3.   The disclosure is objected to because of the following informalities:

a.   A typo exists on page 13 line 30 that references "FIG. 5", but should instead read

--FIG. 4--. Paragraphs preceding this line discuss Figures 2 and 3, and the paragraph

starting at line 10 on page 15 discusses FIG. 5. It thus appears that page 13 line 30

should refer to FIG. 4.

b.   A typo exists on page 14 line 29, as it appears to refer to element "82" of FIG. 5,

while the surrounding text more accurately describes element --72-- of FIG. 4.

c.   A typo exists on page 17 line 19 that reads "**note** the store", but should instead

read --**not** the store--.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

5.   Claims 1-5, 7, 10-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over "A

Comparison of Full and Partial Predicated Execution Support for ILP Processors" by Scott A.

Mahlke et al. (hereinafter "Mahlke") in view of U.S. Patent 6,516,463 to Babaian et al.

(hereinafter "Babaian").

In regards to claim 1, Mahlke discloses:

Apparatus (page 145: "HP PA-RISC processor") *for transforming computer software, said computer software comprising a branch operation for conditionally bypassing a memory write operation* (page 140, Figure 1(a)), *the apparatus comprising:*

    i. code for creating a storage location; – See Mahlke page 142 Figure 2: "cmov temp1,temp3,Pin" This code snippet shows usage of a temporary storage location at "temp1".

    ii. code for moving said memory write operation above said branch operation; – See Mahlke page 141 column 2 Section 3: "The compiler eliminates branch instructions by introducing conditional instructions. The basic transformation is known as if-conversion."

    iii. code for selecting a target address for said memory write operation, wherein said storage location is selected if said branch operation bypasses said memory write operation – See page 140, Figure 1(b) and 1(c) for predicated selection of memory storage addresses. Also Mahlke page 141 column 1:

```
select dest,src1,src2,cond
```

...If the condition is true, the contents of src1 are copied to the **destination**, otherwise the contents of src2 are copied to the destination register.

Here, Mahlke's "select" operation is chosen by the compiler to replace a branch operation wherein depending upon the value of "cond", either "src1", or "src2" is selected.

> *iv. code for replacing an original address in said memory write operation*
>
> *with said target address.* - See Mahlke page 142 bottom of column 2:

> Then a conditional move is used to **replace the address** of the store with *$safe_addr*
> when the predicate of the store is false.

Mahlke does not expressly disclose any computer readable medium.

However, in an analogous environment, Babaian teaches: *a. one or more*

computer readable storage media; and b. computer executable program code stored in

the one or more computer readable storage media (Babaian column 5 line 23 – column 6

line 29). It would have been obvious to one of ordinary skill in the art at the time the

invention was made to use Babaian's teaching of a computer readable medium with

Mahlke's compiler. One of ordinary skill would have been motivated to store the

compiler instructions on long term storage for intermittent retrieval by a computer

system.

In regards to claim 2, the above rejection of claim 1 is incorporated. Mahlke

further discloses: *wherein said code for selecting said target address selects said original*

address if said branch operation does not bypass said memory write operation. – See

Mahlke page 140, Figure 1 and page 141 column 1 as cited above in the rejection of

claim 1. Similar to the condition in claim 1, a different path of execution is taken based

on the predicated value.

In regard to claim 3, the above rejection of claim 1 is incorporated. Mahlke

further discloses: *wherein said code for creating, moving, selecting and replacing*

transforms said computer software into low level program code for performing a conditional memory write without a branch operation. – Mahlke's discussion is inherently concerned with scheduling of low level program code (e.g. predicated code), and discusses the transformation of control dependent branching code into data dependent code without a branch operation through if-conversion (page 138 column 2).

In regard to claim 4, the above rejection of claim 3 is incorporated. Mahlke further discloses: *wherein said low level program code is functionally equivalent to said computer software.* – Mahlke generally discusses code generation through use of a compiler (page 148 Section 5 paragraph 1). Compilers are required to maintain functional equivalence when transforming high level software to a low level representation. See "Compilers: Principles, Techniques, and Tools" by Aho et al. for more information (hereinafter "Aho").

In regard to claim 5, the above rejection of claim 3 is incorporated. Mahlke further discloses: *wherein said low level program code comprises Assembly code* – See page 140, Figure 1.

In regard to claim 7, the above rejection of claim 1 is incorporated. Mahlke further discloses: *wherein said computer executable program code comprises a compiler* – See page 148 Section 5.

In regard to claim 10, the above rejection of claim 1 is incorporated. Mahlke further discloses: *wherein said code for selecting said target address for said memory write operation comprises a select operation* – See page 141 as cited above in the rejection of claim 1.

In regard to claim 11, the above rejection of claim 1 is incorporated. Mahlke further discloses: *wherein said code for selecting said target address for said memory write operation comprises a conditional move operation* – See page 141 column 1: "cmov dest,src,cond".

In regard to claim 12, Mahlke discloses a conditional memory write operation – See page 140 Figure 1(a) as cited in the rejection of claim 1: "if (a&&b) j = j + 1;". All further limitations have been addressed in the above rejection of claim 1.

In regard to claim 13, the above rejection of claim 12 is incorporated. All further limitations have been addressed in the above rejection of claim 7.

In regard to claim 14, the above rejection of claim 12 is incorporated. Mahlke further discloses: *wherein said code for selecting bases said selection on a result of a condition in said conditional memory write operation* – See page 141, top of column 1.

In regard to claim 15, the above rejection of claim 14 is incorporated. Mahlke further disclose: *wherein said code for selecting selects said address of said local variable if said condition is not satisfied* – See page 141, column 1 for details on selecting various local addresses upon evaluation of conditionals.

In regard to claim 16, the above rejection of claim 12 is incorporated. Mahlke further discloses: *wherein said computer software is written in a high level language, and wherein said code for creating, selecting, and performing transforms said computer software into low level program code for performing a speculative store* – Page 140, Figure 1(a) discloses software written in a high level language. See page 145 column 1 for details on generation of assembly code and speculation. The bottom of page 142 discloses details on memory stores in the context of speculation. Also, page 139 bottom of column 2.

In regards to claim 17, the above rejection of claim 16 is incorporated. All further limitations have been addressed in the above rejection of claim 4.

In regards to claim 18, the above rejection of claim 16 is incorporated. Mahlke further discloses: *wherein said low level program code contains no control-flow dependencies* – See page 141 column 2 first paragraph.

In regards to claims 19 and 20, the above rejection of claim 16 is incorporated.

All further limitations have been addressed in the above rejections of claims 5 and 6,

respectively.

In regard to claim 21, Mahlke discloses:

Apparatus (page 145 "HP PA-RISC processor") *for transforming computer*

software, comprising:

means for reading source code, wherein said source code includes a conditional

memory write operation;- Page 140, Figure 1(a) discloses source code with a conditional

memory write.

means for generating functionally equivalent code from said source code, wherein

said functionally equivalent code contains a data-flow dependency,- Figure 1(c) discloses

generation of functionally equivalent source code with data-flow dependencies. *and*

wherein said functionally equivalent code is not fully predicated – While Figure 1(c)

shows code that is fully predicated, Section 2.2 and 3.2 discloses transformation of this

fully predicated code into partially predicated code. See page 142 column 2:

> In the second step of the transformation from fully predicated code to **partially predicated code**, a set of simple transformations, referred to as basic conversions, are applied to each remaining predicated instruction independently. The purpose of the basic conversions is to replace each predicated instruction by a sequence of instructions with **equivalent functionality**.

6.   Claims 6, 8, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the

combination of Mahlke and Babaian in view of Aho.

In regard to claim 6, the above rejection of claim 3 is incorporated. Mahlke does not expressly discloses machine language code. However, in an analogous environment, Aho teaches that compilers are often used to generate machine language code – See the bottom of page 1. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Aho's teaching of machine language code with Mahlke's compiler. One of ordinary skill would have been motivated to be able to execute generated code directly on a microprocessor for increased speed of execution.

In regard to claim 8, the above rejection of claim 1 is incorporated. Mahlke does not expressly disclose an assembler. However, Aho teaches that some compilers perform the job of an assembler – See page 17: "Assemblers". It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Aho's teaching of assemblers with Mahlke's compiler. One of ordinary skill would have been motivated to generate machine language code from assembly code in order to directly execute the code on a microprocessor.

In regard to claim 9, the above rejection of claim 1 is incorporated. Mahlke does not expressly disclose generating a storage location per compilation unit. However, Aho describes selecting memory locations for each of the variables used by the program – See page 15: "Code Generation". It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Aho's teaching of storage location with

Mahlke's compiler. One of ordinary skill would have been motivated to ensure that data

is not lost since each result must be saved in a storage location.

Conclusion

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to J. Derek Rutten whose telephone number is (571) 272-3703. The

examiner can normally be reached on M-F 6:30-3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Tuan Q. Dam can be reached on (571) 272-3695. The fax phone number for the

organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jdr

WEI Y. ZHEN
PRIMARY EXAMINER